Picotrack Endurance User Manual

Version 2.6

Endurance Primary

Endurance Rechargeable

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1 Introduction

Key characteristics of the Picotrack Endurance devices are the extremely long duration battery lifetime and low maintenance requirements. The Picotrack Endurance is suited for a wide range of asset tracking applications, which includes the following types of assets (this list is not exhaustive!):

- Containers
- Freight Wagons
- Trailers and swap bodies
- Construction machines
- Boats
- Large, long-life and mobile industrial equipment

As different applications may have similar but slightly different requirements for long-term low maintenance tracking, Telic offers two variants of the Picotrack Endurance, the Endurance Primary and the Endurance Rechargeable. While software features of both units are nearly identical, they do differ in the shape of the enclosure as well as in internal hardware components.

1.1 Picotrack Endurance Primary

The Picotrack Endurance Primary (non-rechargeable battery) is the ideal choice for all applications with medium to low tracking frequencies and the requirement for an ultra-long battery stand-by time. Picotrack Endurance Primary provides the following advantages:

- Ultra long stand-by time (more than 8 years with 1 transmission per day)
- Higher temperature range for operation
- Extremely low battery self-depletion
- IP69k housing

Figure 1: Picotrack Endurance Primary

	Attempting to charge the primary cell can result in damage or injury!

1.2 Picotrack Endurance Rechargeable

This version is best suited for applications with higher tracking frequencies and the ability to occasionally recharge the battery. Picotrack Endurance Rechargeable provides the following advantages:

- More appropriate for higher tracking frequencies
- IP67 grade housing; IP67 connector is used for configuration and charging (USB-power supply)
- No effort to replace batteries

Figure 2: Picotrack Endurance Rechargeable

2 Delivery content

The standard delivery includes the Endurance device plus 16 screws. The delivery could include furthermore some of the following accessories, depending on the details of your purchase order:

Accessory Name	Order Code	Functionality	Picture
USB-Charging cable for Picotrack Endurance Rechargeable	17013		
USB-Cable for Config- Tool Picotrack Endurance Rechargeable	16211	Use this cable to charge the Endurance Rechargeable and to configure the device via Config-Tool	
USB-Cable for Config- Tool Picotrack Endurance Primary	16210	This cable allows to configure the Endurance Primary via Config-Tool	

Table 1: Accessories List

2.1 Technical Data

The following table lists key technical parameters for the products:

Components	Picotrack Endurance Primary	Picotrack Endurance Rechargeable
Dimensions	230 x 130 x 41 mm	230 x 130 x 41 mm
Connectors	No external connectors	IP67 charging cable
IP Protection Class	IP69k	IP67
Status LEDs	3 indicators for the states: GSM, GPS, battery charging/full (rechargeable only), DOTA, On/Off button…	
GSM/GPRS module	Quadband-GSM-Module (850 MHz / 900 MHz / 1800 MHz / 1900 MHz)	
GPS Sensitivity (Tracking)	-165 dBm	
GPS Acquisition Time	Cold ~ 34sec ; Warm ~ 33 sec ; Hot < 1 sec	
GPS Channels	22/66 tracking / acquisition	
Battery	12.6 Ah Primary cell	13.8 Ah Lithium Polymer rechargeable
Message Logging Capacity	2800	
Sleep mode average consumption (GPS+GSM off)	70 µA	
Average Power consumption for one message cycle (acquire position and transmission) within 180 sec	36mA	
GSM/GPS antennas	Both integrated	
Operating temperature range	-30°C to + 75°C	-20°C to +60°C
Recharging Temperature		0°C to +45°C
Supply voltage	None	5V USB
Weight	~550 g	~550 g
Certificates	ROHS CE certified	ROHS CE certified

Table 2: Technical parameters for the product

3 Operation Set up

The operation set-up of the Asset Tracking device can be realized in few quick steps.

	Please take proper measures for ESD protection (e.g. electrical connection of the body to ground) to make sure you do not destroy internal electronics! Repair of ESD damages caused by user's negligence will not be covered by Telic's warranty. Electrostatic discharge (ESD) is the sudden and momentary electric current that flows between two objects at different electrical potentials normally caused by static electricity.

3.1 Schematics of the device

The following figure shows the physical dimensions of the housing and should assist in mounting the device:

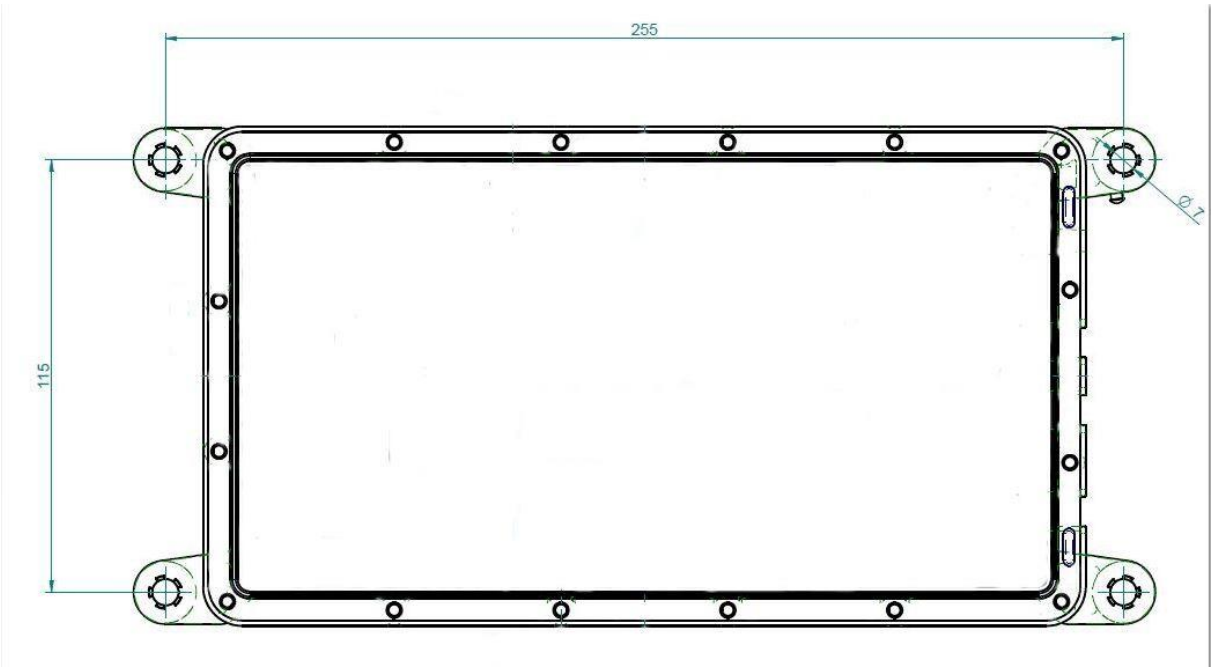

Figure 3: Physical Dimensions of the housing

3.2 Opening the device

Open the Picotrack Endurance housing by removing the screws on the outside edge of the housing (see Figure below). When the screws are removed lift the top of the device in order to reveal the circuit board underneath.

3.3 Inserting the SIM Card

A working SIM card from a suitable network provider must be properly inserted in order for the device to operate correctly.

	The messages of the Picotrack are transmitted via the mobile GSM network. Therefore you need a standard 3 Volts or 1.8 Volts SIM card. Please give preference to post-paid SIM cards!

To insert the SIM card first open the SIM card holder by gently sliding the top of the holder back and then swinging it into the upright position. Then slide the SIM downwards (direction of arrow) into the top of the SIM card holder as shown in the figure below (equally applicable for Picotrack Endurance Primary & Rechargeable).

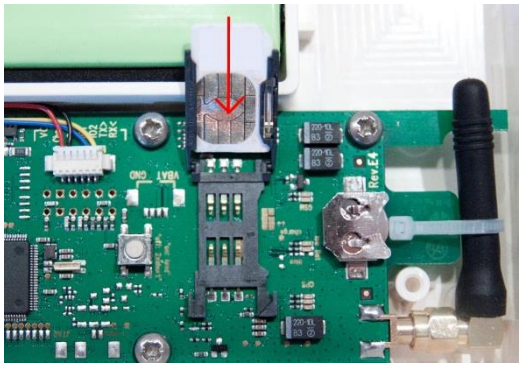

Figure 4: Where to insert the SIM Card (Example: Endurance Rechargeable)

With the SIM inserted close the top of the holder and gently slide it forward (direction of arrow below) until it snaps into place.

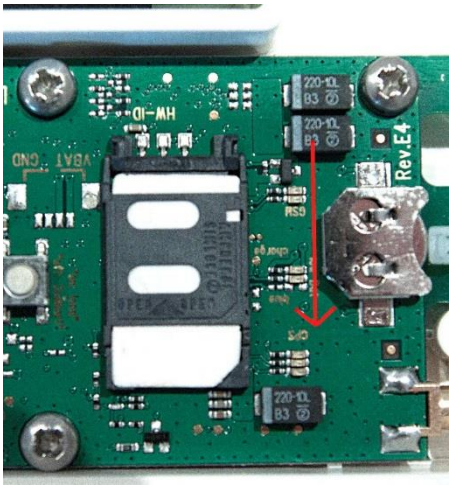

Figure 5: Plugged-in SIM Card (Example: Endurance Rechargeable)

Before the Picotrack logs into the mobile GSM network, it checks whether the used SIM card is PIN free. If it is PIN free, it will start normal operation.
If the SIM card is not PIN free, please ensure that the PIN is set to “0000” before it has been inserted. The PIN can be changed e.g. with a normal GSM mobile phone to “0000”.
To speed up the log-in into the GSM network, the SIM card should not contain any phone book entries.

	Do not touch the GPS antenna in order to avoid contamination of the receiver which may lead to a reduction of receiving quality (should you be forced to clean the pad sometime, please do so using pure alcohol).

3.4 Connecting the Battery

The device is delivered by Telic GmbH with the internal battery disconnected from the electronic PCB. Plug the battery inside the PCB connector as shown in Figure 6 and check that the LEDs starts blinking.

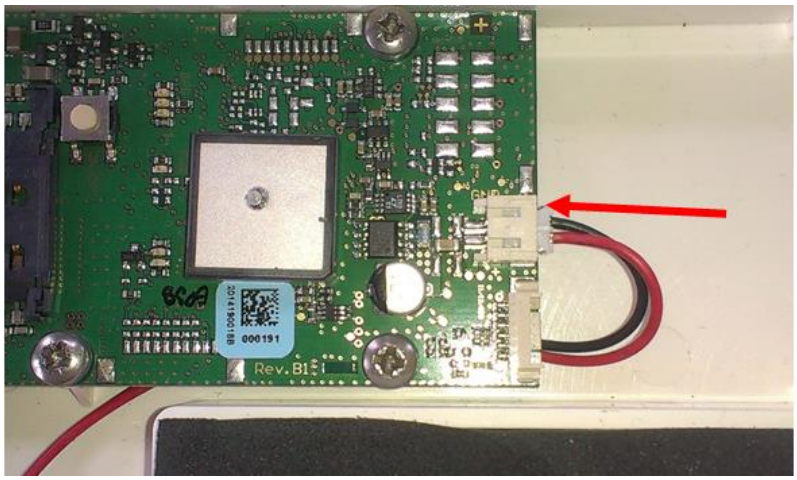

Figure 6: Connecting the Battery cable

3.5 Switching the device ON of OFF

Telic delivers the devices switched-OFF.

- **To switch on the device:** push the small push button on the PCB until the green LED of the left GSM-indicator starts to light-up.
- **To switch-off the device:** open the device and push the button twice in quick succession.

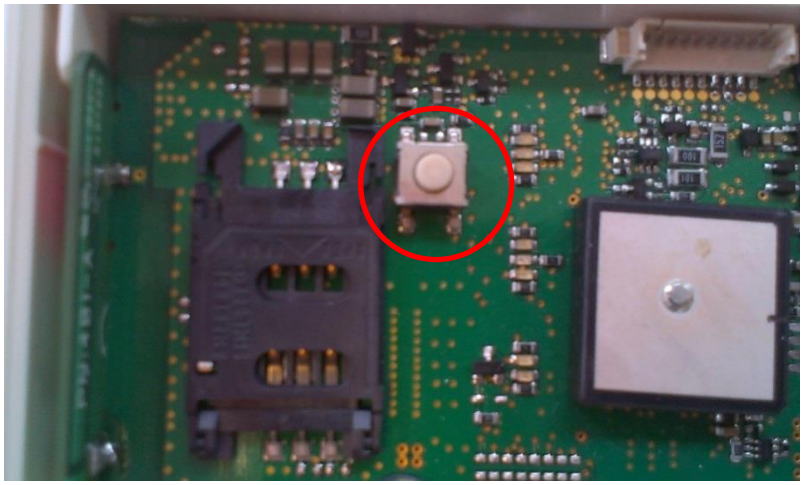

Figure 7: Switching the device on and off (Example: Endurance Primary)

3.6 Closing the device

Please take care that the housing covers fit together tightly and properly, and that the rubber gasket is still in place.
With the cover in place re-insert and tighten down all the screws. Be careful not to over tighten the screws as it will damage the casing and could lead to a reduction in the effectiveness of the environmental protection of the housing.

Please close the housing by screwing the Phillips screws down back into its original position. The clear plastic light guides must be located above the LEDs. Please ensure that the cover locks properly into position.

Min. torque M = 1,2 Nm
Max. torque M = 1,5 Nm

3.7 Status indicators

Internally the device has three status indicators; each indicator has 2 or 3 different coloured LEDs grouped close together.

Components	Picotrack Endurance Primary / Rechargeable
Right indicator (GPS)	This indicator includes 3 LEDs under its glass (yellow, green and red) and reflects the status of the GPS reception as well as the device reset. **off:** GPS is not switched on **1 time blinking yellow** position acquisition not possible **2 times blinking green** 2D-Fix (no valid height and the position may be imprecise) **3 times blinking green** 3D-Fix (GPS data are complete) About 5 seconds red during device reset (in this case also the red LED of the middle indicator is on at the same time).
Middle indicator	The middle indicator consists of two LEDs (yellow and red). **Yellow LED is permanently on**: this indicates that the device has external power supply and the battery is currently charging (only applicable for Picotrack Endurance Rechargeable). If the device is in sleep mode, the middle indicator works identically; just the left and the right indicator are off. Remark: If the middle LED is off, this does NOT mean, that the Telic Picotrack tracking and tracing module is switched off. In fact it only indicates that the device is not connected to external power supply. The **red LED** indicates the following: This one and the red right indicator are permanently on during the

Components	Picotrack Endurance Primary / Rechargeable
	whole DOTA (Software-Update Over-The-Air) procedure. During download of data when the DOTA is running, the green LED on the left indicator is also on. It is blinking red when the battery is “Low”, indicating that the battery needs to get recharged soon, otherwise the Picotrack will switch off automatically. In case of an internal device reset this LED will be on for about 5 seconds and then return to its initial status. At the same time the red LED of the right indicator will be also switched on. Also whenever the internal button is pushed the middle LED will illuminate red in order to indicate the button is being pushed.
Left indicator	The left indicator consists of both a green LED and a red LED. The green LED reflects the GSM status and also, whether the device is switched on. When the LED is off, the device is switched off. Permanently on means, GSM is switched on, but no GSM network is available. Blinking once means the device is logged into the GSM network. Blinking twice indicates an established TCP/IP connection to the server. Slow double blinking of the red LED means that the SIM card is not readable (e.g. not correctly inserted into the SIM cardholder). After a certain period of time the Picotrack Endurance will switch-off completely (as it would be after pushing twice the red on/off button).

Table 3: Status indicator

4 Configuring the unit via serial interface

In order to reconfigure or read trace values from the device via the serial interface, the correct cable must be plugged into the proper connector.

	Negative consequences on safety and device integrity may occur when connecting the wrong cable to the unit and which is not listed in the Telic accessory list.

1. ENDURANCE PRIMARY

The device has to be opened by removing the cover lid and the cable (accessory part number 16210) has to be plugged into the 6-pin white connector as shown in Figure 8. Afterwards the white button has to be pressed until the LEDs start blinking.

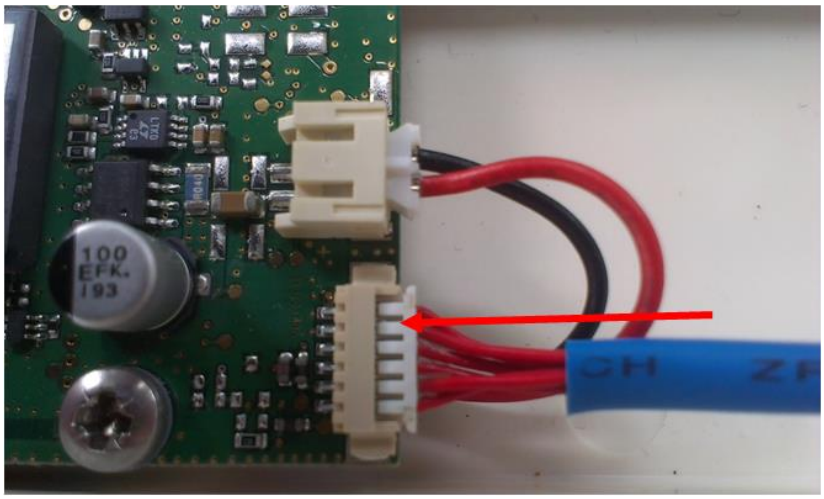

Figure 8: Connecting serial interface cable to the Endurance Primary

2. Endurance Rechargeable

Open the small black lid on the top right side of the device; it needs to be pulled out.

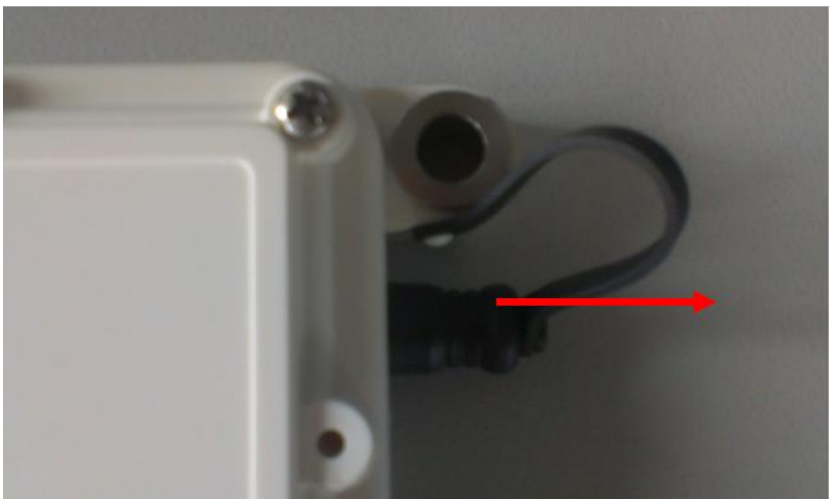

Figure 9: Where to plug the configuration cable inside

Plug inside the configuration cable (Accessory Part Number 16221)

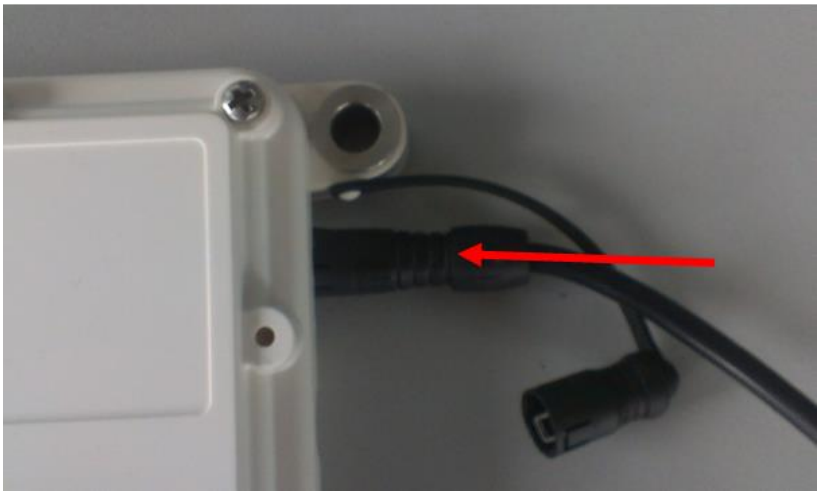

Figure 10: Plug inside the configuration cable

	If the device is not configured to activate by motion, it is necessary to open the cover and press the white button like in the Primary cell device version. In order to preserve the IP67 enclosure rating, do not forget to plug the small black lid after using the serial interface, before deploying the device in the field.

5 Troubleshooting Hints

5.1 The device doesn't show any sign of life

Possible issue source	Trouble shooting
The device is not connected correctly	Please connect the device following instructions in the user manual.

Table 4: Troubleshooting: Device doesn't show any sign of life

5.2 The device doesn't log into the GSM network

Possible issue source	Trouble shooting
The device isn't in a GMS covered area	Please check whether there is GSM reception in this area (e.g. using a cell phone) and move eventually to another area.
The position of the Picotrack device is not favourable.	Choose another place in the vehicle which might be less shielded.
The SIM card in the Asset Tracking device is new and has not yet been activated	Please check, whether the SIM card is already activated. This can be done e.g., by putting the SIM card into your cell phone and checking, whether your cell phone is able to log into a GSM network.
The SIM card has been locked by the provider	Please check whether the SIM card is locked. This can be done e.g. by putting the SIM card into your cell phone and checking, whether your cell phone is able to log into a GSM network. If this not the case, then please try to make a phone call. If you are successful, the SIM card is definitely not locked.
The prepaid bonus is exhausted	Please recharge the SIM card in the Picotrack device.
The prepaid SIM card is no longer valid	If they aren't recharged on a regular basis (often after 12 or 24 months). In this case usually you have to buy a new SIM card.
The PIN code of the card has not been deactivated or is not set to "0000"	Please remove the SIM card from the device and check the PIN code. The Pin code has to be deactivated or set to "0000" After a triple wrong entry of the PIN, unblocking the SIM card requires the PUK.
The SIM card hasn't been inserted into the SIM card holder in the correct way	Please check the correct position of the SIM card in the card holder.

Table 5: Troubleshooting: Device doesn't log into the GSM network

5.3 The device doesn't log into the GPRS network

Possible issue source	Trouble shooting
The GPRS service is not yet activated	Please ask your provider, whether the GPRS function is already activated for the SIM card in use.

Table 6: Troubleshooting: Device doesn't log into the GPRS network

5.4 The device doesn't send messages

Possible issue source	Trouble shooting
Battery of the device was completely drained (e.g. after several months of storage)	Please recharge the device (Picotrack Endurance Rechargeable only) and wait for 3D GPS fix to synchronise the internal real time clock.

Table 7: Troubleshooting: Device doesn't send messages

5.5 The device doesn't receive GPS data

Possible issue source	Trouble shooting
The position of the device is not favourable for the GPS reception	Please check, whether the device has the indicators facing up and a clear view of the sky.
The GPS receiver has no free sight to the sky	Please be aware, that a GPS receiver needs always a clear view of the sky. Please ensure that the device side with the LEDs has free view to the sky.
Your asset is placed in an unsuitable location	Please consider that a GPS reception operates most efficiently when there is a free view of the sky. If GPS reception is not available (e.g. due to location of the asset inside a warehouse), considering using the Device-based Wireless Positioning feature as an alternative positioning method (see Section 7.4).

Table 8: Troubleshooting: Device doesn't receive GPS data

Further hints regarding sources of error are indicated through the 8 LEDs of the 3 indicators, which are easily visible from outside. You will find details for the meaning of the different colours and blinking signs in chapter 3.7 ("Status indicators").

6 Basic Features

The device can be configured via serial cable by using the Telic Configuration tool otherwise remotely via SMS and GPRS. Please contact Telic GmbH to have more details about the configuration procedure.

6.1 Event Types

The Picotrack Endurance's primarily task is to transmit GPS position data, including additional status information via a TCP/IP connection to the tracking server. If a message can't be transmitted, it will be stored in the device to be transmitted later. There is a storage capacity of about 1.000 position messages. The following events will generate a position message which always contains the GPS position:

- **Time Event:** The end of a time period of x seconds (x being configurable).
- **Distance Event:** After a distance of x meters (straight line distance to the previous event) in any direction (x being configurable) has been travelled.
- **Angular Change Event:** A direction change of a configurable minimum angle in x degrees (x being configured) at a configurable minimum speed of y km/h (y being configurable).

6.2 Connection Establishment Procedure

The GSM and GPS modules will power up after switching on the Picotrack device. After logging in into the GSM network the Picotrack will attempt to establish a GPRS communication link. Finally a TCP/IP connection to the tracking server will be established to transmit the event messages.
The selection of the GSM network operator will take about 1 minute, plus the time to build up the GPRS- and TCP/IP-connections to the tracking server. Therefore, after switching on the device, it will take approximately 2-3 minutes until the first status message can be transmitted. Independent of this procedure, GPS positions and status information will be generated and stored in the internal memory for later transmission. Here follows the message structure:

6.3 Event Message Structure

The first identified and valid GPS position will be taken as the reference position for the distance interval calculations. The next distance interval event will be generated if the configured distance has been reached. If another event (e.g. time interval event) has been generated before, the distance interval measurement starts again at the position of this new event. That means that any position message with an actual GPS position sets a new reference for the distance interval calculations. This reduces the number of messages sent while still keeping the desired resolution of the track.
A position message will also be generated in the case of a direction change being greater than the configured angle while travelling at the configured minimum speed.
In situations where no new valid GPS position is available, the last valid position will be transmitted.

Content	Description
Event/Log -Code	Reason for the status message
Event/Log Timestamp	Time at which the event has happened

Content	Description
GPS Timestamp	GPS timestamp at the moment of fetching longitude and latitude
Longitude	Degree of longitude (default: in 100µ degrees; can be decreased to 1µ degrees precision)
Latitude	Degree of latitude (default: in 100µ degrees; can be decreased to 1µ degrees precision)
Fix Type	1, 2, 3 or 6 depending on the availability of satellites in view having a sufficient signal strength: ▪ 1D Fix (no valid data) ▪ 2D Fix (no height indication) ▪ 3D Fix (position message with height indication) ▪ 6 (GSM Tracking; Endurance Primary only; must be activated in the device)
Speed over ground	Speed in km/h
Sats for calculation	Actual number of satellites which are used for calculation
Height	Height above sea level (in m)
Mileage	Mileage in km
DigIns	Relevant for Endurance Rechargeable only: 4 digits e.g. 0010, if charger is connected
Analog Input 1	Value of the analogue input 1 in mV (Battery voltage with a precision of 1/10 volts)
MotSens	Status of the motion sensor

Table 9: Content description

7 Advanced Features

In this paragraph are described some advanced features supported by the device, which might be requirement for different use cases.

7.1 Geofencing

Geofencing (an electronic safety fence) provides the opportunity to set a geographic square around a defined location. Here you can set different scenarios like “leaving the area” or “entering the area” and transmit an event to the control centre. With the Picotrack Endurance you can monitor 50 geofence areas which can also be combined to create larger areas and build up a complex protection zone. Every geofence area is given an Area ID, a centre (defined by its longitude and latitude) and a height and width (from the centre not completely across) in meters.

Figure 11: Geofencing

7.2 Roaming alternative configuration

The device is able to detect a GSM roaming status and swap automatically to an alternative setup for roaming (this alternative setup has to be previously configured). This allows optimizing the data traffic and reducing the communication costs.

7.3 Device Watchdogs

The Picotrack has different integrated watchdogs. They automatically check the functions of the device and generate resets as soon as they recognize any malfunction. Malfunction could occur due to internal problems of the device, problems related to the GSM connection, problems with the GPS reception and many more.

This watchdog concept ensures that the Picotrack can automatically return to stable operation if necessary. Control of the watchdogs by the user is not necessary.

If the watchdog has to restart the device it may happen that some of the position messages and respectively events are not logged and as a result they are not transmitted to the tracking server.

7.4 Device based wireless positioning (GSM Tracking)

The device can be configured in order to get a localization obtained by the GSM module, in case that the GPS has some difficulties on providing a valid fix. Of course this position will be less accurate and take a bit longer than the standard way by GPS module, therefore this functionality has to be considered as emergency backup for the GPS.

Note that this feature is only available with the Picotrack Endurance Primary.

	A lot of other features are available on Picotrack Endurance but they are kept as “confidential”, therefore not disclosed on this document. Please contact the Telic Technical Pre-Sales support in case that your specific use case requires something which you don´t find described in this document.

8 Device Installation on Board

The device should be installed in a location where it is well-hidden in order to protect your asset from theft and vandalism. Please install the device in a suitable, dry location, not in contact to generators of radio and audio frequency interference. Be aware to observe ESD (Electro Static Discharge) protection measures. When installing the device consider that antennas are integrated, this means the device should be installed in a place with a minimum distance of 7 cm to metallic components of the asset in each direction. The surface of the internal GPS antenna should be pointing skywards in order to optimize the quality of the received signal.

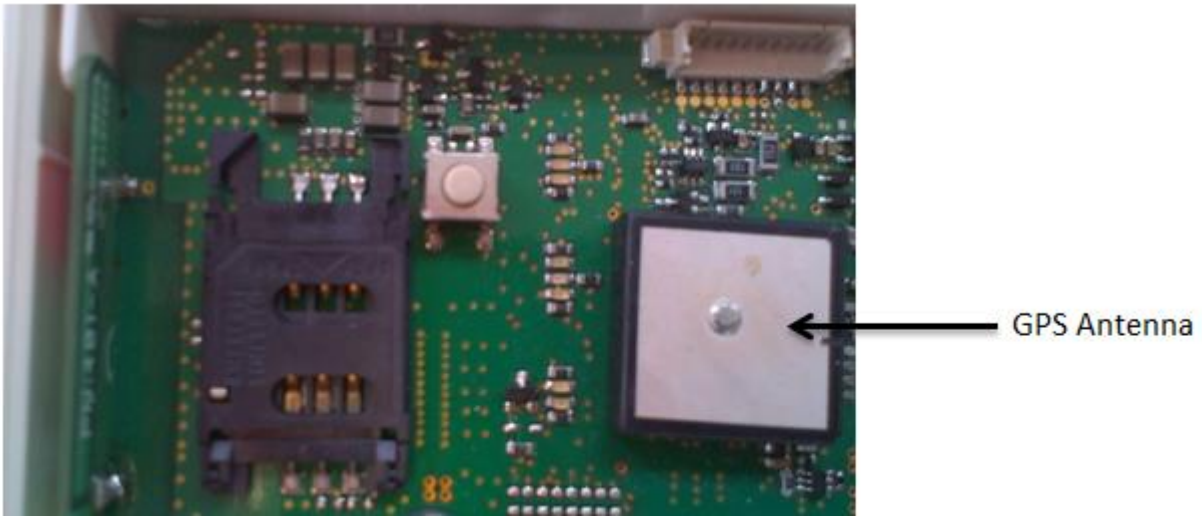

Figure 12: Installation on board (Example: Endurance Primary)

The unit can also be placed on the lateral side of the Asset or even below it if the optimal installation described above is not possible. Consider, though, that this might have the following effects:

- Reduction of the device's battery life time due to the GPS module requiring more time and higher power consumption to get a fix.
- Less precise fix. The accuracy of the fix might be affected by reflections of the GPS signals. It is advisable to configure in such cases the unit to perform 2D fixes.
- No fix possible. In this case, it is possible to get a rough position by device-based GSM tracking (Picotrack Endurance Primary only), but the battery lifetime of the unit will also be adversely affected.

9 Safety

The following guidelines must be followed in order to ensure the safety of users. If these rules are ignored Telic will not assume responsibility for any damages that are incurred.

9.1 General battery handling

Because the Picotrack Endurance main power source is a battery with high energy content. They are designed to represent the highest possible degree of safety. They may, however, present a potential hazard if they are abused electrically or mechanically. This is in most circumstances associated with the generation of excessive heat. In this case the internal pressure may cause the cell case to rupture.
As a result the following general guidelines should be followed when handling the Picotrack Endurance Battery:

- Do not short-circuit
- Do not over discharge
- Do not incinerate
- Do not expose to temperatures beyond the specified temperature range
- Do not crush or puncture
- Do not open cells, do not disassemble battery packs
- Do not expose contents to water
- Do not connect with false polarity
- Do not weld or solder to the battery's body

It is very important that only authorized official Telic replacement batteries be used in the Picotrack Endurance Rechargeable or Primary. Also the batteries included with the devices are only tested or authorized for use in the Picotrack Endurance. The batteries should never be used in any other devices unless specifically authorized by Telic, including but not limited to other Telic products or devices.
No attempt should ever be made to recharge the Picotrack Endurance Primary battery. This Primary cell is specifically not rechargeable and attempting to do so would be very dangerous.

9.2 Battery storage

Batteries should be stored in rooms with generally low temperature and low humidity levels. While it is not essential that these storage areas be temperature and humidity controlled, temperatures should generally be kept below 35 °C and storage areas should be well ventilated. Storage temperatures above 75 °C should be avoided.
Your Picotrack Endurance batteries should be stored in their original packaging materials or in the Picotrack Endurance itself. This will eliminate unintentional shorting. Do not store batteries in conductive anti-static bags or foam unless the resistivity of the material exceeds 1 MΩ. Batteries should not be placed on or covered with metallic or otherwise conductive material.
Batteries should be stored away from any flammable material in the storage area. Fire extinguishers for metal fire (class D) are preferred. Do not attempt to extinguish fires with small amounts of water, sand, or with carbon dioxide extinguishers.

9.3 Battery disposal

The disposal or recycling of batteries is regulated by each European country. In each country, the manufacturers, importers and users are responsible for the proper disposal. The European Community (EC) has issued two directives, 91/157/EEC and 93/86/EEC. These directives are implemented by each member country of the EC independently and in a different way. In

accordance with these directives, The Picotrack Endurance Batteries do not contain dangerous substances. The reaction products are inorganic and do not represent environmental risks once the decomposition process has terminated.

10 General Terms and Conditions

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11 CE Declaration of Conformity

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CE Konformitätserklärung
Declaration of Conformity

Hiermit wird erklärt, dass unser Produkt
hereby we declare that our product

Picotrack Endurance Primary

den folgenden Normen und Richtlinien entspricht
is in compliance with the following European Standards and regulations

Nummer / Kurztitel *Number / Title*	Eingehaltene Vorschriften *Observed regulations*	
R&TTE-Richtlinie 99/5/EG EMV-Richtlinie 2004/104/EG *R&TTE-Directive 99/5/EG* *EMC- Directive 2004/104/EG*	ETSI EN 301489-1 V1.8.1: 2010	*Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirement*
	ETSI EN 301489-7 V1.3.1: 2006	*Electromagnetic compatibility and Radio spectrum Matters (ERM) - ElectroMagnetic Compatibility (EMC) standard for radio equipment and services - Part 7: Specific conditions for mobile and portable radio and ancillary equipment of digital cellular radio telecommunications systems (GSM and DCS)*
	DIN EN 55022 VDE 0878-22:2011-12	*Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement (CISPR 22)*
	DIN EN 55024 VDE 0878-24;2011-0	*Information technology equipment – immunity characteristics – Limits and methods of measurement (CISPR 24)*
	EN 60950-1:2006	*Safety of information technology equipmen*
	ETSI EN 301 511 V9.0.2: 2003	*Global System for Mobile communications (GSM); Harmonized EN for mobile stations in the GSM 900 and GSM 1800 bands covering essential requirements of article 3.2 of the R&TTE directive (1999/5/EC)*

Oberhaching, den 02.04.2014

Frank Heineck; Board Member

12 Documentation change LOG

Revision	Date	Change
Rev .2.0	21/01/14	First release on new layout
Rev. 2.1	14/04/2014	Add the CE Declaration of Conformity
Rev. 2.2	22/05/14	Update Installation on board (Section 7)
Rev. 2.3	23/05/2014	Update Figure description (Figure 4,5,6,8) Update Endurance Rechargeable Picture
Rev.2.4	26/05/2014	Update Technical Data
Rev. 2.5	11/07/2014	Update Section 3.4 and 4
Rev. 2.6	09/01/2015	Update Section 3.6

Table 10: Documentation change LOG